DOCUMENT RESUME

ED 253 119 FL 014 873

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TITLE Phonetic Aspects of Children's Elicited Word Revisions.
PUB DATE 12 Oct 84
NOTE 24p.; Paper presented at the Boston University Conference on Language Development (9th, Boston, MA, October 12-14, 1984) and at the Annual Meeting of the Acoustical Society of America (108th, Minneapolis, MN, October 9, 1984).
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Child Language; *Communication Problems; *Communication Skills; *Language Acquisition; Language Patterns; *Phonetics; *Pronunciation; Suprasegmentals; Young Children

ABSTRACT

A study of the phonetic changes occurring when a speaker attempts to revise an unclear word for a listener focuses on changes made in the sound segment duration to maximize differences between phonemes. In the study, five-year-olds were asked by adults to revise words differing in voicing of initial and final stop consonants; a control group of adults was tested with the same paradigm for comparison. In addition, the children's revision behavior was examined for its relationship to phonemic awareness and reading ability. Results showed that both children and adults made segmental changes in duration while preserving total word duration in elicited word revisions. Voicing distinctions were consistently maintained in revised speech. All subjects appeared to follow a general revision strategy regardless of the source of miscomprehension, altering the duration of segments that relate to the final consonant in the target words rather than and perhaps at the expense of the vowel's duration. Other changes such as amplitude, fundamental frequency, and spectral changes were not measured. Illustrative oscillograms and graphs are included. (MSE)

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Phonetic aspects of children's elicited word revisions

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FL014873

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Phonetic aspects of children's elicited word revisions

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A study was conducted to investigate the phonetic changes which occur when a speaker attempts to revise an unclear word for a listener. Previous work on revision behavior in adults and children has focused primarily on semantic and syntactic modifications following breakdowns in communication (e.g., Gallagher,1977; Garvey,1977; Longhurst & Siegel,1973; Valian & Caplan,1979; Valian & Wales,1976). Little attention had been directed to revision behavior at the phonetic level. Adjustments of speech at the phonetic level may occur when a speaker responds to a listener's feedback that the pronunciation of a given word is unclear. In most conversational exchanges a speaker, when faced with a request for revision, will attempt to maximize the intelligibility of an earlier utterance. The speaker may then alter the pronunciation of the original utterance. In order to clarify a word, a speaker may change certain phonetic characteristics to maximize differences between phonemes. In this investigation, the concentration was on one aspect of the speech signal, namely sound segment duration.

Sound segment duration is one acoustic aspect of speech which distinguishes certain phonemes. In fact, it is known that changing the duration of sound segments is a strategy some adults use to clarify utterances in certain registers, such as when adults speak to children, and during concerted efforts to speak clearly (e.g., Baran,1979;

Chen,1980; Malsheen,1980; Picheny & Durlacn,1979). Changing sound segment duration, then, may be a revision strategy that adults use, and children develop, in an attempt to enhance acoustic cues for a listener when asked to clarify an utterance.

It is a well known fact that the distinction between voiced and voiceless stops is signalled primarily by differences in temporal relationships between sound segments. The voicing contrast of word-initial stop consonants is differentiated principally, although not exclusively, by Voice Onset Time or VOT (Lisker & Abramson,1964). VOT is longer for voiceless than for voiced initial stops. Relative differences in segment duration also signal a voicing contrast for stops in word-final position. In most languages, a longer vowel occurs preceding a voiced rather than a voiceless final consonant (Chen,1970; Peterson and Lehiste, 1960). In this study, an attempt was made to determine whether temporal cues for stop consonant voicing are modified when speakers are asked to revise their speech.

Control of duration of speech segments to distinguish voicing for initial and final stop consonants is established in 5-year-old children (see Kent,1976), the age of the children studied in the present investigation. The knowledge that children have the ability to use temporal parameters to signal linguistic distinctions in a manner similar to adults in speech production is not sufficient to establish that children can also modify their speech at a phonetic level when a listener requests that they revise their original utterance.

The present investigation was designed to examine certain phonetic aspects of 5-year-old children's speech in response to adult requests

for revision. The children were asked to revise words that differed in voicing of initial and final stop consonants. A control group of adults was also tested with the same paradigm. Another focus of the study was to determine whether children's revision behavior is related to an aspect of metalinguistic skill, phonemic awareness.

The following durational aspects of speech were examined in original and revised utterances:

1. VOT of initial stops;
2. Vowel duration;
3. Final consonant closure duration;
4. Final consonant release duration;
5. Total word duration.

These dependent variables were used to examine the following questions:

1. Do 5-year-old children make different phonetic alterations than adults in their response to revision requests?
2. Do children and adults respond differently to revision requests when the source of miscomprehension is the initial or final stop consonant; or when the revision request provides only a general signal of miscomprehension?
3. Is there a correspondence between the types of phonetic changes 5-year-olds make and their awareness of phonemes and reading ability?

Four adults and sixteen 5-year-old boys and girls served as experimental subjects. All subjects were native English speakers from monolingual homes. All subjects passed screening tests of hearing

acuity, articulation skill, and auditory discrimination ability.

Four single-syllable words beginning and ending with a stop consonant were selected as target words for the experiment: back, pack, cab, and cap. These words contrast in word-initial and word-final voicing. The target words were presented in the context of a 12 word list that contained 8 additional words used as buffer items.

The design of the experiment included one baseline, i.e., a no revision request condition, and three different revision conditions. The differential effect of the type of revision request was assessed in the following manner:

In the baseline condition, subjects were asked to repeat each word after the experimenter, resulting in ten repetitions of each target word. This condition was presented first as a precaution against subjects getting into a "revision mode" and producing all words more clearly after a revision request was first posed. For the three revision elicitation conditions, subjects were asked to repeat words presented with the additional instruction that they may be asked to say a word again because the examiner had to be sure that the words would be understood on the tape. All target words, and some buffer words were followed by a revision request. The examiner indicated misperception of the initial or final consonant of a word by asking specific questions. For example, for the target word back, the examiner would ask either "Did you say ack?" or "Did you say ba?" The examiner also indicated general misperception by asking, "What did you say?" For a given block of trials the different types of requests for revision were presented in random order. Each target word was revised ten times in each of three

revision elicitation conditions. Subjects were tested individually in an IAC booth, and all responses were recorded.

Oscillograms were made of the target word responses. The following measurements were made: VOT, vowel duration, final consonant closure duration, and final consonant release duration (see Figure 1). The sum of all these segmental components is the total word duration. The measurements of the segmental components were converted to proportions of the total word to correct for within- and between-subject variability in total word duration.

The statistical procedure used to analyze the data was a 4 (stimulus word) x 4 (elicitation condition) x 3 (order of response) univariate analysis of variance (ANOVA) for repeated measures (Winer,1971). For the analysis of the child data, a between-subject factor of sex was added. For each subject group, a separate ANOVA was conducted for each dependent variable.

Results and Conclusions

Results of this investigation showed modifications in vowel and closure duration in revised speech for adults and 5-year-old children. The effect was a decrease in vowel length and a corresponding increase in closure duration for revised responses. For the adults, vowel duration across revision conditions was about 10% shorter than in the no revision request condition (see Figure 2). A lengthening of about 5% in closure duration occurred in the revised conditions compared with the no revision condition (see Figure 3). No statistically significant change occurred for VOT or release duration for the adult group.

There was a similar significant change in vowel duration and closure duration in revised speech for the 5-year-old children. Children showed a decrease of about 6% in vowel duration in revised speech compared to speech in the no revision condition (see Figure 4). An increase of about 6% in the final consonant closure duration occurred in revision conditions (see Figure 5). Children, in contrast to adults, did show a significant difference in VOT as a function of revision condition. A slightly shorter VOT occurred in the final request condition compared to the no request condition (see Figure 6). The children, like the adults, did not show any differences in final consonant release duration in their revised speech.

Since a shorter vowel and longer closure duration is a characteristic of words with voiceless final stops, it appears at first that all revised words were becoming more like words with voiceless stops. For adults and children, however, the distinction between voiced and voiceless final stops was maintained across revision conditions for vowel and closure duration. In all conditions, the word with a vowel prior to a voiced final stop was longer than in words with voiceless final stops (see Figures 7 and 8). Similarly, in all conditions, the closure duration of words with voiceless final stops was longer than that for a word with a voiced final stop (see Figures 9 and 10). Thus, linguistic distinctions for voicing were maintained by adults and 5-year-old children in revised speech even when a shorter vowel and longer closure period occurred compared to unrevised speech.

Despite the fact that segmental adjustments in duration occurred in revised speech for children and adults, total word duration did not vary

significantly as a function of revision condition. Speakers appear to cluster around a consistent word length across conditions. Since the target words were monosyllables, these results support the argument that the duration of syllabic units is relatively constant. Such findings have been reported for adult speakers (see Chen,1970; Lehiste,1972), and apparently children, as young as 5 years, show the same tendency.

Even though both children and adults showed the same pattern of maintaining overall word length across multiple responses, the absolute word durations for adults and children were significantly different (see Figure 11). Adults took less time to say the same words than children. Generally the words produced by the adults were about 140 msec shorter than those produced by the children, and adults were less variable than the children. These results are consistent with other research that has compared word durations of adults and children (e.g., Kent and Forner,1980; Kubaska & Keating,1981; Smith,1978).

The influence of two other variables on performance on the experimental tasks was also assessed. First, since there were ten repetitions of each target word, there was a concern that such redundancy would have an effect on the dependent variables. Consequently, a comparison was made between the first three, middle four, and final three repetitions of the target words. The results showed that there were no differences in any of the dependent variables that were related to the order in which words were repeated, and this was true for adults and children.

The second variable evaluated was the sex of the child subjects. The analysis showed that there were no significant main effects or

interactions due to sex.

In the experiment, as described earlier, children were asked to repeat selected words after the experimenter indicated misperception of either the initial or final consonant segment of a word. Thus, awareness of sound segments may have been advantageous and may have aided performance on the experimental task. Without knowledge of a child's segmentation ability, it would have been difficult to evaluate the child's responses in the event that no change was seen in the revised productions. Therefore, a series of sound segmentation tasks was administered to each child subject. It has also been suggested that phonemic awareness may be necessary, or at least beneficial in learning to read (see Blachman, 1984; Golinkoff,1978). Therefore, it was thought that children who could read may have been more responsive to the specific type of revision request. Thus, children's reading ability was also assessed.

Although performance on sound segmentation tasks correlated highly with reading ability for the children in this study, no correspondence between segmentation and reading ability and revision behavior was found. That is, the degree of acoustic-phonetic change seen in the revised words was not related to the subjects' segmentation and reading ability. This result may be due to the fact that children, like adults, appeared to follow a general revision strategy regardless of the nature of the revision request. The only analysis which showed significant differences that were due to the type of revision elicitation condition was VOT for the children.

In conclusion, both children and adults made segmental changes in

duration while preserving total word duration in elicited word revisions. Voicing distinctions were consistently maintained in revised speech. All subjects appeared to follow a general revision strategy regardless of the source of miscomprehension. They all altered the duration of segments that relate to the final consonant in the target words. The subjects may have considered it more necessary to enhance the final consonantal portion of the word than the vowel. Their revision strategy appeared to be to lengthen the closure duration in an attempt to emphasize the final consonants. This strategy may have simultaneously induced them to shorten the vowel. Vowel length reduction has been frequently associated with longer closure duration in word-final stop consonants (Chen,1970). A form of temporal compensation apparently occurred in order to maintain a basic word duration (Lehiste,1972). Such revision behavior in word-final stop consonants may have resulted, at least in part, because the source of misperception was always focused on the consonants and not on the vowel. Other changes such as increased amplitude, increased fundamental frequency, or spectral changes, may have occurred in revised speech; but these were not measured in the present study. Finally, this experimental task does not appear to require or benefit from either sound segmentation or reading ability.

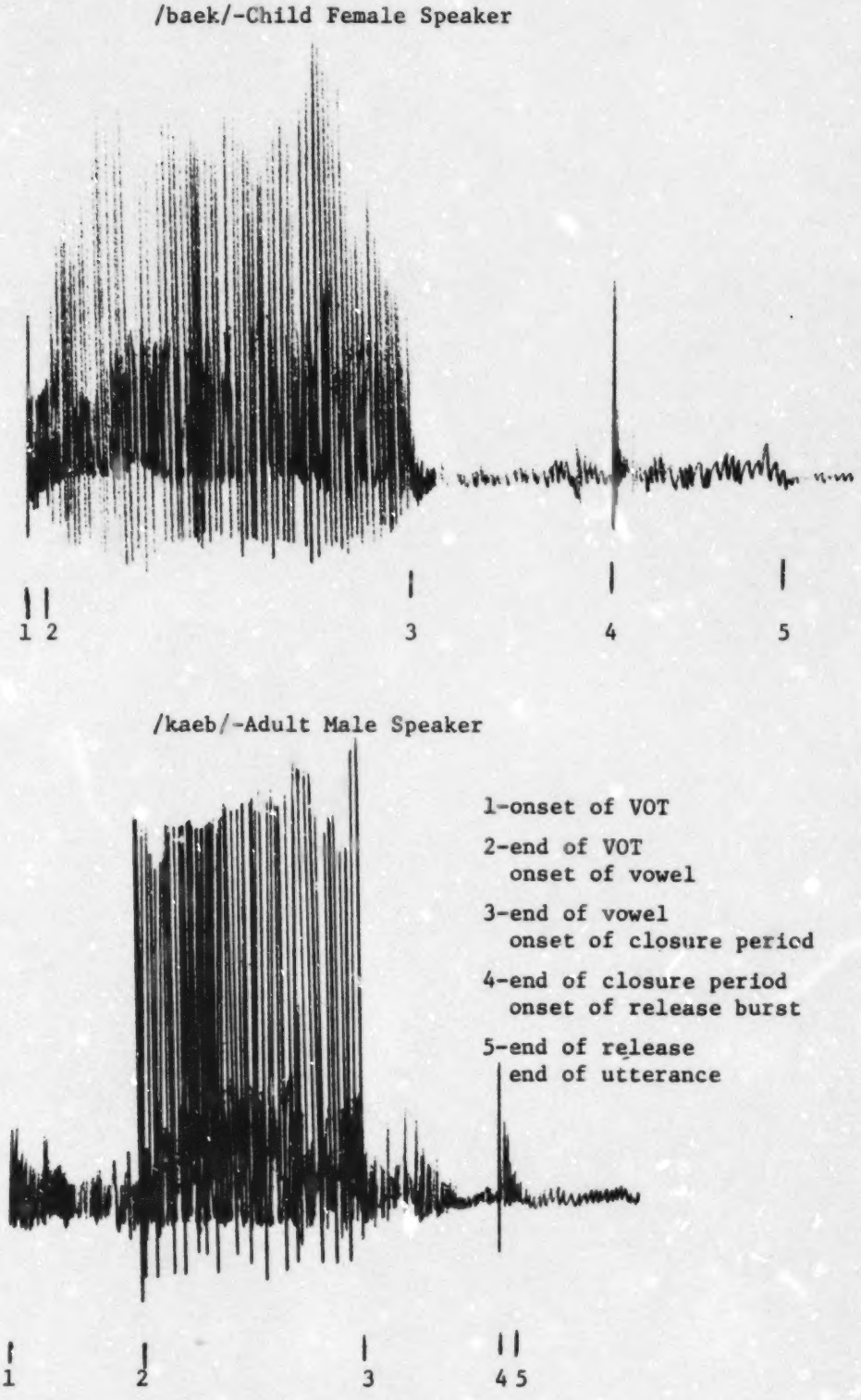

Figure 1. Oscillograms with segment onset and termination points marked. (Traced for illustrative purposes).

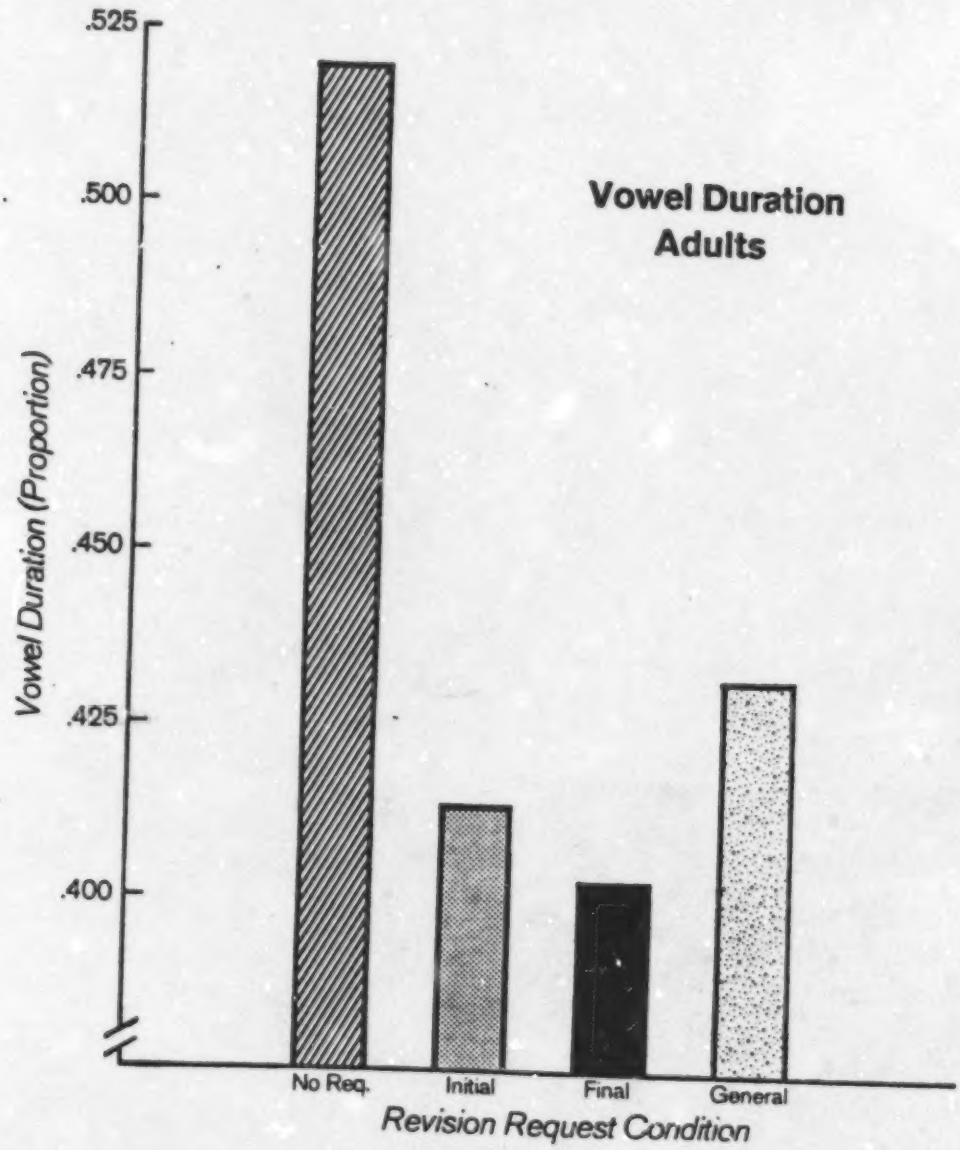

Figure 2. Mean vowel duration as a function of revision request condition for the adult group.

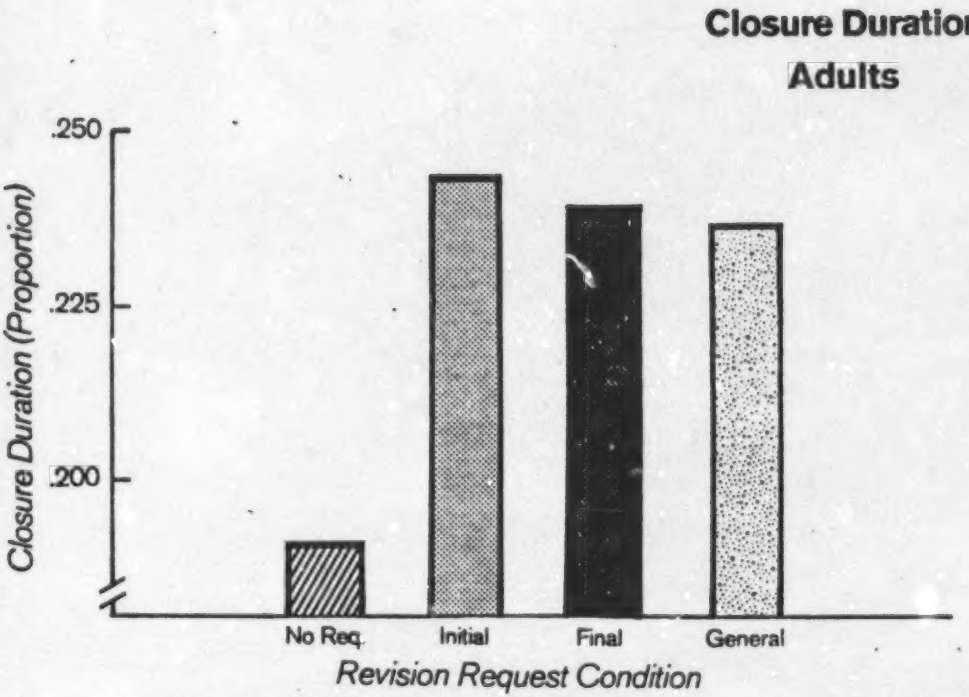

Figure 3. Mean closure duration as a function of revision request condition for the adult group.

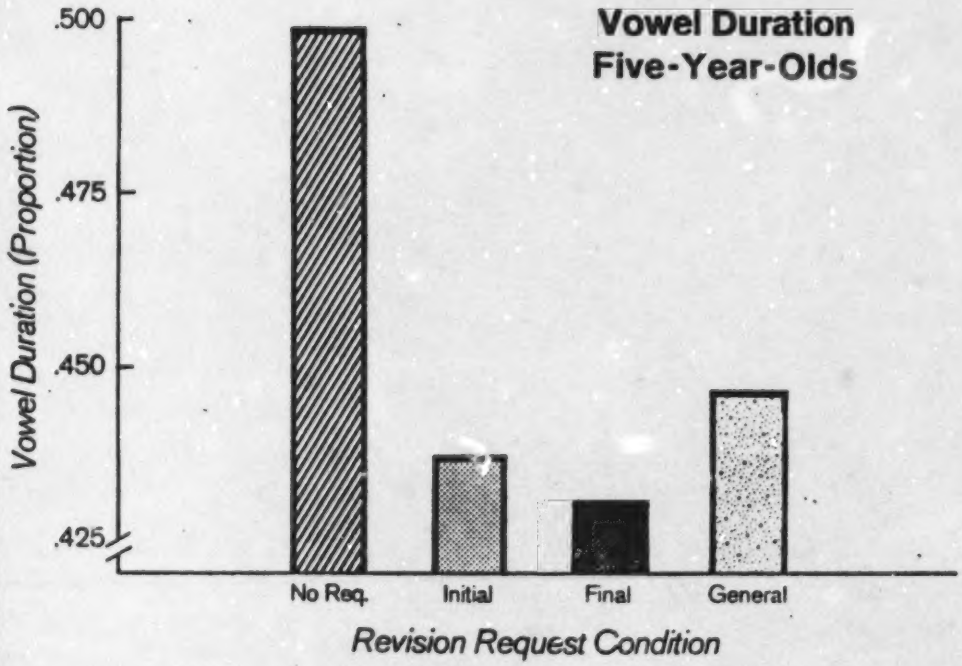

Figure 4. Mean vowel duration as a function of revision request condition for the child group.

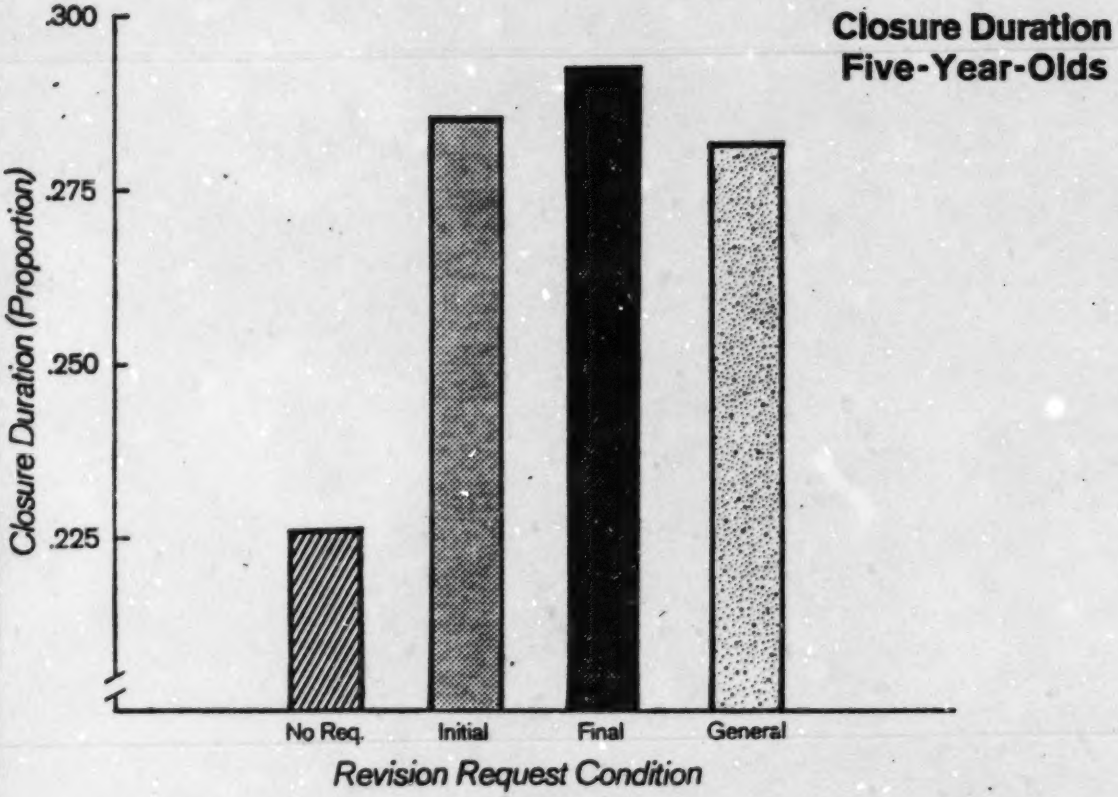

Figure 5. Mean closure duration as a function of revision request condition for the child group.

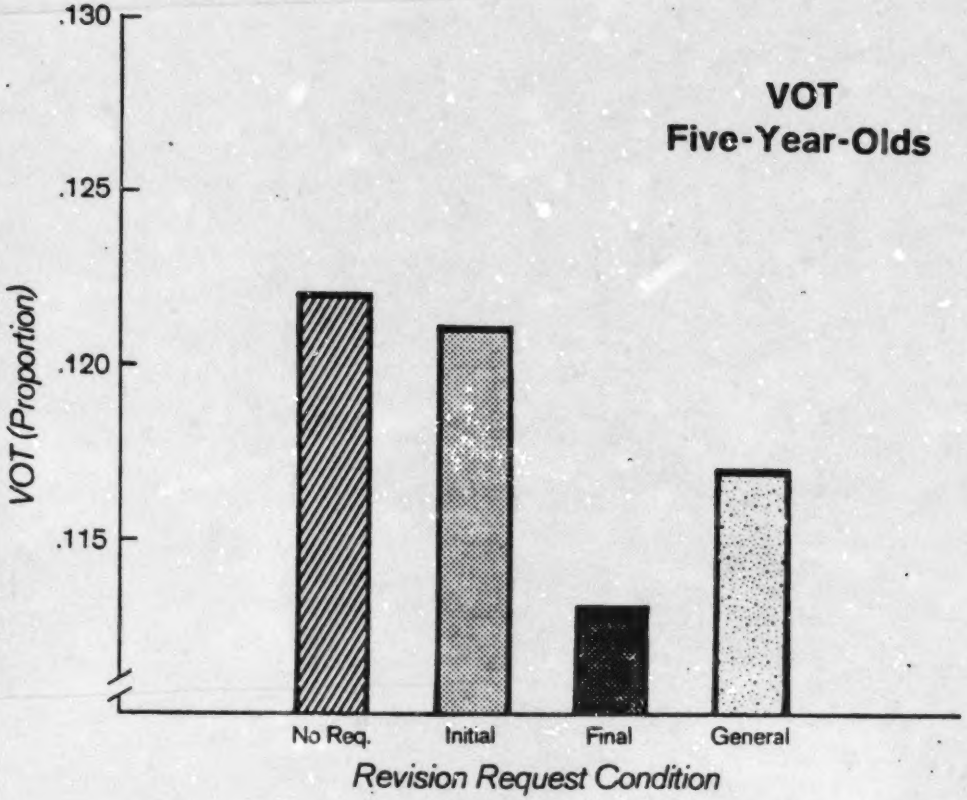

Figure 6. Mean VOT as a function of revision request condition for the child group.

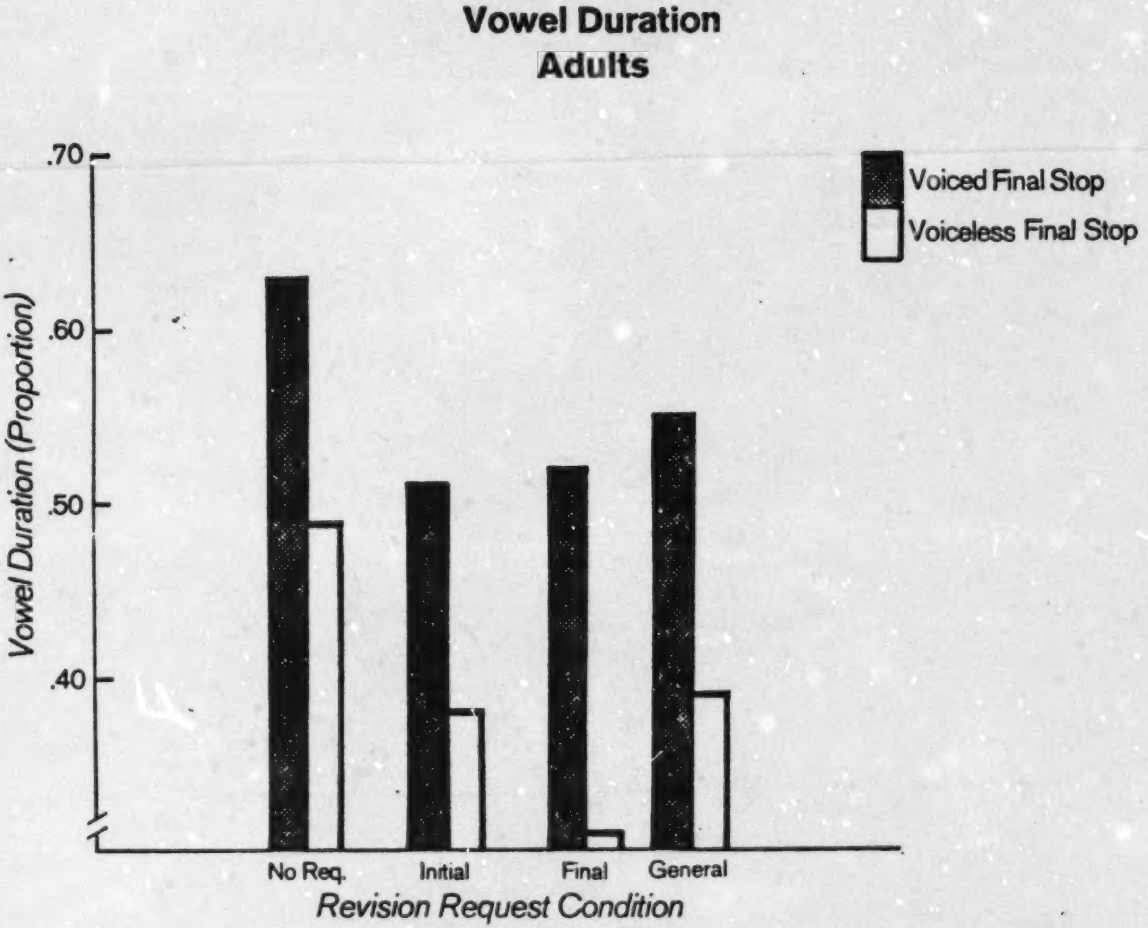

Figure 7. Mean vowel duration of word-final stops: voiced stop (cab) versus voiceless stops (back, pack, cap) as a function of revision request condition.

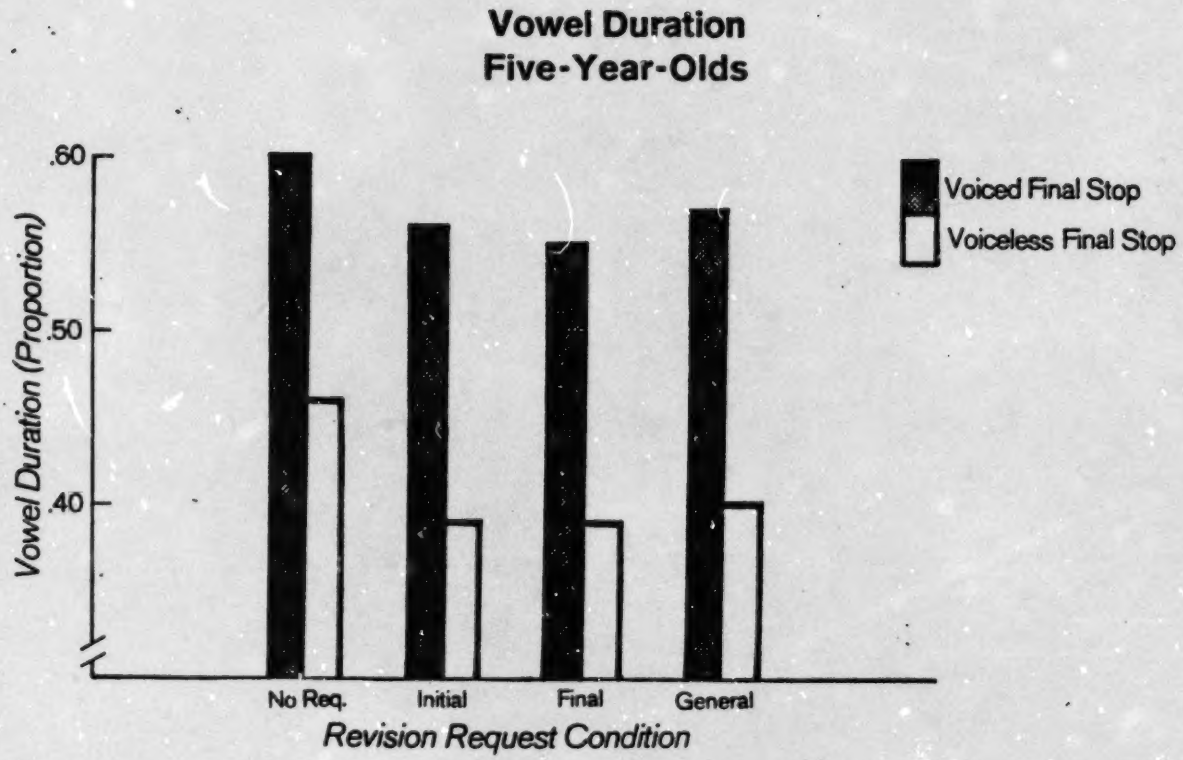

Figure 8. Mean vowel duration of word-final stops: voiced stop (cab) versus voiceless stops (back, pack, cap) as a function of revision request condition.

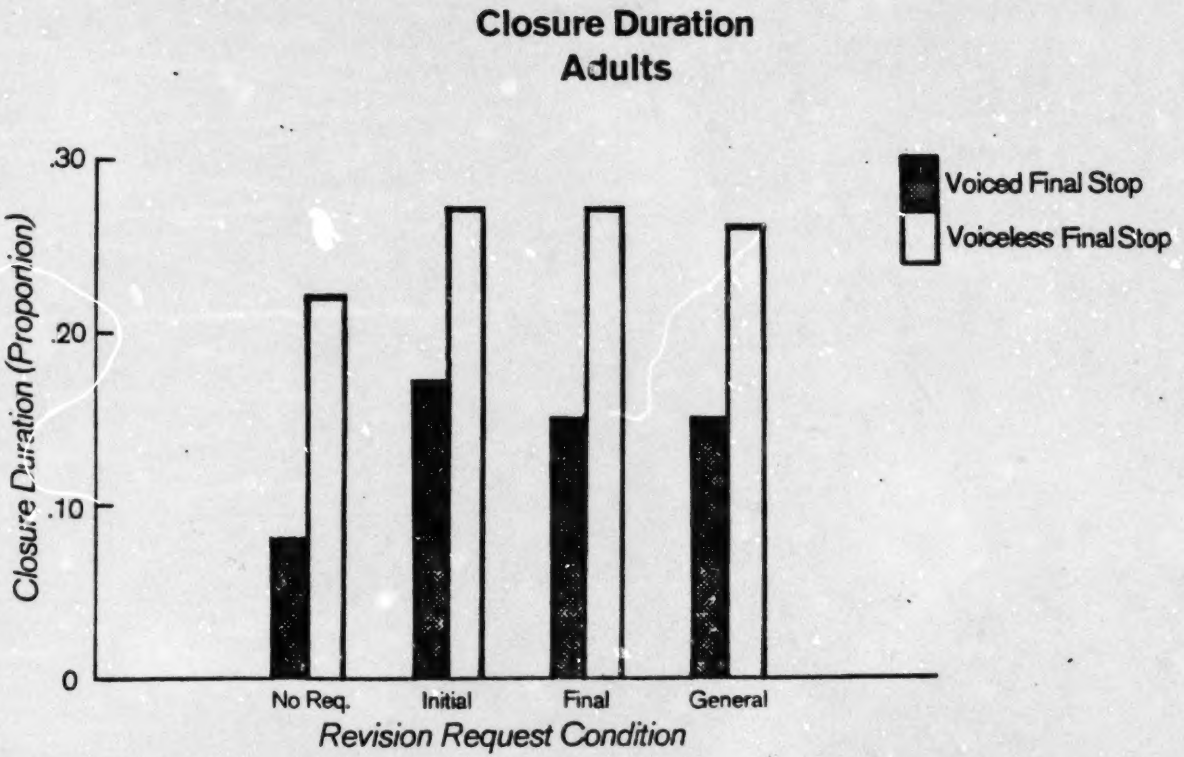

Figure 9. Mean closure duration of word-final stops: voiced stop (cab) versus voiceless stops (back, pack, cap) as a function of revision request condition.

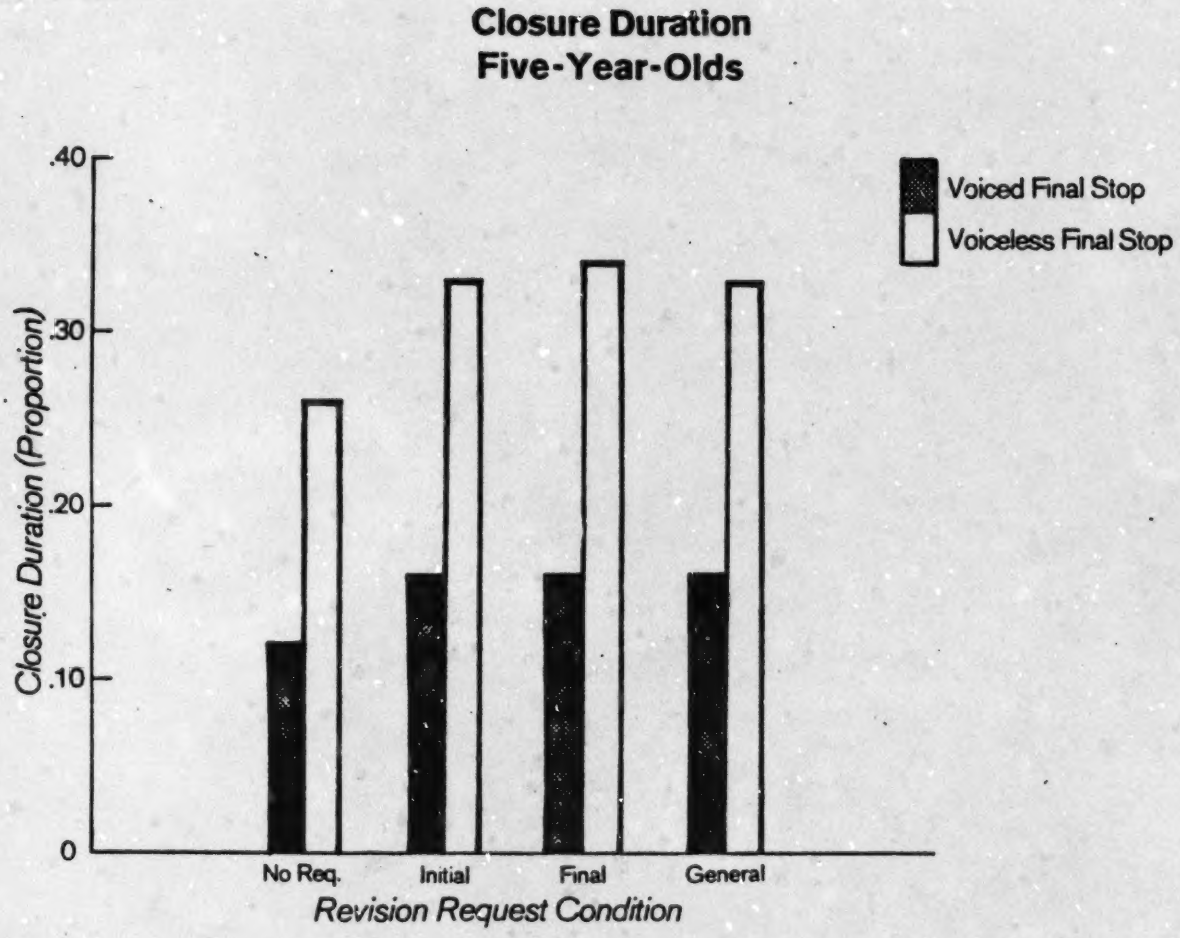

Figure 10. Mean closure duration of word-final stops: voiced stop (cab) versus voiceless stops (back, pack, cap) as a function of revision request condition.

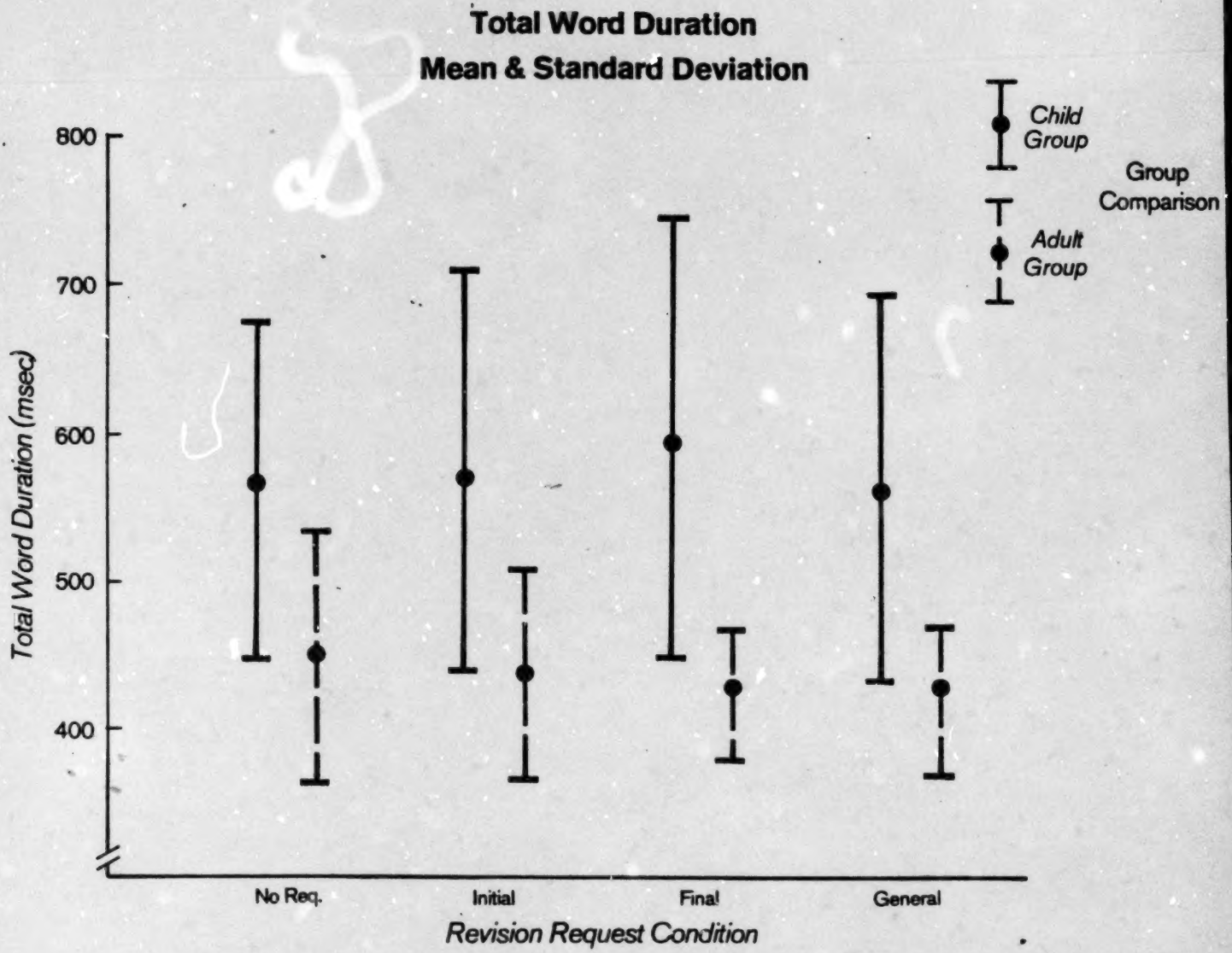

Figure 11. Mean total word duration bracketed by standard deviation. Comparison of child and adult groups.

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